

IV. ENDANGERED OR THREATENED SPECIES

The 316(b) does not specifically discuss the potential impact of the Monroe plant intake on threatened or endangered species. No species of fish appearing on the federal endangered or threatened species list (U.S. Fish and Wildlife Service 1977) were reported in Detroit Edison's impingement and entrainment records, but muskellunge and burbot, classified by the MWRC (1975a) as threatened in Zone 8, which includes Lake Erie, were reported in the records. Our extrapolations show that an estimated 89 muskellunge were impinged at the Monroe plant during June 1975-May 1976 (Table 3), and that 17,358 burbot eggs were entrained by the plant during February 13-14, 1976 (Table 19).

V. IMPACT OF MONROE POWER PLANT INTAKE ON RAISIN RIVER

The entire flow of the Raisin River is diverted through the Monroe plant for cooling water, except during periods of very high runoff when some flow can escape through the old river mouth (Cole, 1976). Yet, the 316(b) contains no discussion of the impact of the plant on the river.

A detailed evaluation of the impact of the Monroe plant operation on the aquatic resources of the Raisin River is probably not possible until more information becomes available on these resources. Although resident fish populations in the upper river would be little affected by the Monroe plant, those populations that required access to both the upper river and to Lake Erie would be denied this access by the Monroe plant. Fish attempting to migrate downstream to Lake Erie would be drawn into the plant's intake canal, and those attempting to migrate from the lake to the upper river would probably enter the plant's discharge canal (rather than the river mouth) and be blocked by the plant from reaching the upper river. During periods when river flow exceeds the plant's cooling water requirements and excess river water enters the lake via the lower river channel, some movement of fish between lake and river could occur. However, USGS records for the years 1975 and 1976 show that flows in the Raisin River in excess of the maximum 3,248 cfs cooling water requirement of the Monroe plant occur in late winter when little movement of fish would be expected between the lake and the river.

Plans for the management of the fishery in the Raisin River were not available at the time of this writing, but MDNR has constructed a fishway on a dam above the City of Monroe and has stocked Pacific salmon smolts in the river above the Monroe plant.

VI. IMPACT OF THE MONROE POWER PLANT ON
YELLOW PERCH IN WESTERN LAKE ERIE

The 316(b) report for Detroit Edison's Monroe plant appears to greatly underestimate the impingement and entrainment losses of some groups of organisms (refer to Sections II-B and III-B) and therefore also underestimates the impacts of plant operation on the source populations in western Lake Erie (refer to Sections II-C and III-C). An example of a more satisfactory approach to estimating the impact of plant operation on these source populations is the one developed by Patterson (1977) for the U.S. Environmental Protection Agency (EPA). Patterson's approach, which involves the use of a population model, projects the annual loss in potential yield of yellow perch to commercial and sport fisheries of western Lake Erie due to impingement and entrainment losses of that species at the Monroe plant. Patterson estimated an annual loss in yield of approximately 98,000 pounds to the yellow perch fisheries of western Lake Erie but based this estimate on the impingement and entrainment losses of yellow perch reported in the 316(b) for the Monroe plant. Consequently, EPA provided us with the following formula (Nelson Thomas, personal communication, September 2, 1977) to calculate the increased annual loss in potential yield resulting primarily from the higher estimated impingement losses of yellow perch given in the present report (Table 3):

$$\begin{aligned} \text{Loss in yield (number of fish)} = & 0.766639 (I_N) + 0.529527 (I_{A1}) \\ & + 0.132382 (I_y + E_y) \\ & + 0.010591 (E_L) \end{aligned} \quad (12)$$

where: I_N = number of adults impinged
 I_{A1} = number of yearlings impinged
 I_y = number of YOY impinged
 E_y = number of YOY entrained
 E_L = number of larvae entrained

This equation applies under the "average" conditions of:

survival fraction of larvae (ϵ) = 0.08
 survival fraction of YOY (s) = 0.25
 reproductive potential of adult (γ) = 25.0
 natural mortality rate (m) = 0.37
 fishing mortality rate (f) = 0.37

The division of the calculated loss in numbers by 3.5 fish per pound (the weight used by Patterson 1977) gives the loss in yield in pounds.

The values for the variables in Equation 12 were determined from the impingement and entrainment estimates of Tables 3 and 19 for 1975-76. The total estimated impingement of 625,580 yellow perch (Table 3) was divided into age classes according to the distribution calculated in Section II-B-3. Thus, $I_N = 441,159$; $I_{A1} = 181,668$; and $I_Y = 2,753$. The age-class components of the total number of yellow perch entrained (4,963,524 from Table 19), calculated from Detroit Edison's daily entrainment data sheets, are: $E_Y = 3,611,638$; $E_L = 1,351,886$.

The above values may still be underestimates of the numbers of yellow perch impinged and entrained by the Monroe plant because of the deficiencies of the sampling methods used by Detroit Edison to collect the data (refer to Sections II-A and III-A) and the biases present in the length distribution of the impinged perch (refer to Section II-B-3); these values, however, are the best available for use at this time.

According to Equation 12 and the above impingement and entrainment estimates, the additional loss in potential yield of yellow perch to the fisheries is:

$$\begin{aligned} \text{Loss (numbers)} &= 0.766639 (441,159) + 0.529527 (181,668) \\ &\quad + 0.132382 (2,753 + 3,611,638) \\ &\quad + 0.010591 (1,351,886) \\ &= 927,206 \text{ yellow perch} \\ \text{Loss (lb)} &= 927,206 / 3.5 \text{ fish per lb} \\ &= 264,916 \text{ lb} \end{aligned}$$

Patterson's model and Equation 12 assume that 70% of the entrained larvae will be killed during passage through the plant. If 100% mortality of entrained larvae is assumed, as in the 316(b), the annual loss in potential yield of yellow perch to the fisheries increases to 266,669 pounds.

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